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EXAMINER
SETH, MANAV

ART UNIT	PAPER NUMBER
2625	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/034,288	BACHELDER, IVAN	
	Examiner	**Art Unit**	
	Manav Seth	2625	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 January 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *6-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *6-18* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1 .17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on January 13, 2006 has been entered.

Response to Amendment

2. Applicant's amendment under 37 C.F.R. 1.17 filed on January 13, 2006 has been entered in full.

3. Applicant's arguments with respect to the claims as presented in the amendment filed have been fully considered but are not persuasive.

Response to Arguments

4. Applicant's arguments regarding the prior art rejections under Adelson, Ohki, Frost, Kubota, and Palmquist on pages 5-8 of the Amendment filed on January 13, 2006, have been fully considered but are not persuasive.

5. Applicant, in various paragraphs (page 6, last paragraph), in whole, argues in substance:

a. Adelson does not teach or suggest the step of defining a plurality of image regions, each of the plurality of image regions corresponding to a location on the object, as claimed by the Applicant. Instead, Adelson teaches that the entire image of each differently-focused image is analyzed to generate a single-focus composite image.

Examiner respectfully disagrees. Adelson clearly teaches defining a plurality of image regions (pixel sample sets) based on the spatial frequency bands where apparently each of the plurality of image regions corresponds to a location on the object when images are take of the specimen (or object) and these regions are then used to compute the composite focused image (Figure 1; col. 4, lines 39-56; col. 4, lines 67-68 through col. 5, lines 1-10; col. 5, lines 25-40). Adelson further discloses the application of such invention by disclosing "while the second of these application relates to use of a television microscope for successively obtaining a series of separately focused 2-D images of different optical sections of a **3-D microscope specimen** (object) being observed". Examiner does not rely on any other reference to provide the above-cited teachings as Adelson has provided them. All other arguments are moot in view of the rejections made before in the previous office action and these rejections still stand.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 6 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Adelson, U.S. Patent No. 4,661,986 and further in view of Ohki, U.S. Patent No. 6,831,694.

Claim 6 recites "a method for generating a focused image of an object from an optical imaging system, the method comprising: **providing a plurality of images of the object, each image having a focus setting; defining a plurality of image regions, each of the plurality of image regions corresponding to a location on the object**". Adelson discloses "This invention relates to an image-processing method and, more particularly, to an image-processing method for deriving a single improved-focus two-dimensional for deriving a single improved-focus 2D image of a 3D scene from a plurality of separately-focused 2-D images of this 3-D scene. The term "scene", as used herein, means a particular region of 3-D space including **all objects** situated within that particular region (col. 1, lines 5-16) where it is clear from the above disclosure that 3-D scene can be an object. Adelson further discloses "As indicated in figure 1, the image processing method of the present invention operates on M separately focused two-dimensional images of the same 3-D scene......Each of separately-focused images 100-1....100-M can be either in sampled or non-sampled analog form, or, alternatively, in sampled digital form.....separate images 100-1...100-M of the fixed scene can be made successfully at different times with the same lensing system adjusted at each of these to a different focus" (col. 4, lines 4-16). Adelson further discloses the application of such invention by disclosing "while the second of these application relates to use of a television microscope for successively obtaining a series of separately focused 2-D images of different optical sections of a **3-D microscope specimen** (object) being observed" (col. 6, lines 41-45). Adelson further discloses defining a plurality of image regions (pixel sample sets) based on the spatial frequency bands where apparently each of the plurality of image regions corresponds to a location

on the object when images are take of the specimen (or object) (Figure 1; col. 4, lines 39-56; col. 4, lines 67-68 through col. 5, lines 1-10; col. 5, lines 25-40).

Claim 1 further recites "measuring a sharpness score for each image region of at least two of the plurality of images; determining a spatial weighting for the image regions using the sharpness score; and computing a composite image of the object by combining each of the plurality of images using spatial weighting". A person using a camera or microscope can determine the optimal or sharp focus by looking at the focused image and then based on his/her capability of viewing image appropriate sharpness or focusing can be selected. But the same problem of obtaining a focused image using an image processing system or a computer system is totally different. A computer system cannot determine the optimal or sharp focus by just looking at the focused image as done by a human operator, but it has to perform some calculations or weighting on the images by considering image characteristics such as measuring high frequency components in an image which is well-known to determine the best focus and Adelson teaches the same where the spatial frequency spectrum (sharpness) of the image regions of the plurality of images are analyzed, the regions further are classified into different spatial frequency bands and further the regions with desired focus with respect to the frequency spectrum associated are selected according to the focus desired (col. 4, lines 25-68; col. 5, lines 25-40, lines 54-68; col. 6, lines 7-14, line 22-31) and further clearly teaches selecting the **highest score region (image region with best focus)** to obtain a focused image and combining the images (col. 5, lines 54-67, col. 6, lines 22-31; col. 8, lines 5-8). Also, Adelson in the background of the invention discloses "A three-dimesnsional image processing technique is described that permits a 3D display to be produced by digitizing the specimen with the focal pane situated at various levels along the optical axis and then processing each resulting image to remove

the defocused information from structures in neighboring planes. This approach makes it possible to roughly separate each section image into 2 components – a sharp component of objects in the plane of focus, and a blurred component contributed by objects lying in the other planes. **By extracting the sharp components and stacking them up**, a 3D microscope scene can be displayed with a significant increase in the depth of field (col. 1, lines 50-65). It is apparent from the above disclosure that Adelson picks the image samples having the best focus where **assigning the best focus to the image sample using sharpness score is spatial weighting of the image sample** done by the system, and when computing a composite image, the image samples selected using spatial weighting are combined which gives the total maximum sharpness score of the image. Adelson does not specifically teach the claimed specific term of determining spatial weighting as part of the focus determination. Spatial weighting of the image based on the sharpness score is well known technique to determine a best focused image, and this well known spatial weighting specifics are further taught by Ohki, to further provide the support to this well known technique.

Ohki discloses an image processing apparatus, method and storage for creating a sharply focused image by the use of a plurality of images having different degrees focus setting (col. 1, lines 5-15) and further discloses computing a composite image of the object by combining each of the plurality of images using the spatial weighting (col. 1, lines 30-68 through col. 2, lines 1-20; col. 10, lines 35-67; col. 11, lines 25-60; col. 13, lines 1-35). Therefore, it would have been obvious for one of ordinary skill in the art at the time of invention was made to use the teachings of computing a composite image of the object by combining each of the plurality of images using the spatial weighting as taught by Ohki in the invention of Adelson because both the references are directed to the same field of endeavor and solve the same problem of obtaining the focused image of the object

and Ohki further teaches that using such as method would permit creation of sharply-focused images at low cost (See Okhi, col. 14, lines 43-45).

Claim 17 recites "the method of claim 6 wherein the fine feature sharpness measurement further comprises: transforming the at least one region of the image so as to provide a plurality of spatial frequencies of the at least one region of the image; measuring a density of high spatial frequencies; and using the density of high spatial frequencies so as to provide a fine feature sharpness measurement". The claim 17 limitations are very well known to be performed in the art of image processing to obtain sharpness score of the image to obtain focused image. **It is well known** in the art that higher frequency component represent the image sharpness (higher the high frequency components, the sharper is the image) and this well known fact has been used in creating focused image of the object. As discussed in rejection of claim 6, Adelson clearly discloses the analysis of the spatial frequency spectrum of the image where the highest frequency band image samples from different images are selected and combined to form a focused image. Also, the same has been disclosed by Ohki (col. 11, lines 53-60).

8. Claims 6, 7, 12-14 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Adelson, U.S. Patent No. 4,661,986 and further in view of Frost et al, U.S. Patent No. 5,647,025.

Claim 6 recites "a method for generating a focused image of an object from an optical imaging system, the method comprising: **providing a plurality of images of the object, each image having a focus setting; defining a plurality of image regions, each of the plurality of image regions corresponding to a location on the object**". Adelson discloses "This invention relates to an image-processing method and, more particularly, to an image-processing method for

deriving a single improved-focus two-dimensional for deriving a single improved-focus 2D image of a 3D scene from a plurality of separately-focused 2-D images of this 3-D scene. The term "scene", as used herein, means a particular region of 3-D space including **all objects** situated within that particular region (col. 1, lines 5-16) where it is clear from the above disclosure that 3-D scene can be an object. Adelson further discloses "As indicated in figure 1, the image processing method of the present invention operates on M separately focused two-dimensional images of the same 3-D scene......Each of separately-focused images 100-1....100-M can be either in sampled or non-sampled analog form, or, alternatively, in sampled digital form.....separate images 100-1...100-M of the fixed scene can be made successfully at different times with the same lensing system adjusted at each of these to a different focus" (col. 4, lines 4-16). Adelson further discloses the application of such invention by disclosing "while the second of these application relates to use of a television microscope for successively obtaining a series of separately focused 2-D images of different optical sections of a **3-D microscope specimen** (object) being observed" (col. 6, lines 41-45). Adelson further discloses defining a plurality of image regions where apparently each of the plurality of image regions corresponds to a location on the object when images are take of the specimen (or object). (Figure 1; col. 4, lines 39-56; col. 4, lines 67-68 through col. 5, lines 1-10; col. 5, lines 25-40).

Claim 6 further recites "measuring a sharpness score for each image region of at least two of the plurality of images; determining a spatial weighting for the image regions using the sharpness score; and computing a composite image of the object by combining each of the plurality of images using spatial weighting". A person using a camera or microscope can determine the optimal or sharp focus by looking at the focused image and then based on his/her capability of viewing image appropriate sharpness or focusing can be selected. But the same problem of obtaining a focused image using an image processing system or a computer system is totally different. A computer

system cannot determine the optimal or sharp focus by just looking at the focused image as done by a human operator, but it has to perform some calculations or weighting on the images by considering image characteristics such as measuring high frequency components in an image which is well-known to determine the best focus and Adelson teaches the same where the spatial frequency spectrum (sharpness) of the image regions of the plurality of images are analyzed, the regions further are classified into different spatial frequency bands and further the regions with desired focus with respect to the frequency spectrum associated are selected according to the focus desired (col. 4, lines 25-68; col. 5, lines 25-40, lines 54-68; col. 6, lines 7-14, line 22-31) and further clearly teaches selecting the **highest score region (image region with best focus)** to obtain a focused image and combining the images (col. 5, lines 54-67, col. 6, lines 22-31; col. 8, lines 5-8). Also, Adelson in the background of the invention discloses "A three-dimesnsional image processing technique is described that permits a 3D display to be produced by digitizing the specimen with the focal pane situated at various levels along the optical axis and then processing each resulting image to remove the defocused information from structures in neighboring planes. This approach makes it possible to roughly separate each section image into 2 components – a sharp component of objects in the plane of focus, and a blurred component contributed by objects lying in the other planes. **By extracting the sharp components and stacking them up**, a 3D microscope scene can be displayed with a significant increase in the depth of field (col. 1, lines 50-65). It is apparent from the above disclosure that Adelson picks the image samples having the best focus where **assigning the best focus to the image sample using sharpness score is spatial weighting of the image sample** done by the system, and when computing a composite image, the image samples selected using spatial weighting are combined which gives the total maximum sharpness score of the image. Adelson does not specifically teach the claimed specific term of determining spatial weighting as part

of the focus determination. Spatial weighting of the image based on the sharpness score is well known technique to determine a best focused image, and this well known spatial weighting specifics are further taught by Frost, to further provide the support to this well known technique. Frost determines a sharpness score and uses the sharpness score to determine the spatial weighting and further determines the optimal focus of the image regions using the spatial weighting (col. 8, lines 5-67). Frost further discloses combining of all successful focused scans to generate a model of the focused surface of the object to obtain an optimal focus setting to attain an optimal focused image (col. 14, lines 40-47). It is apparent from the above disclosure that it would be obvious for one of ordinary skill in the art to first obtain an optimal focus setting to obtain an optimal focused image. Therefore, it would have been obvious to one having the ordinary skill in the art at the time of the invention was made, to use the teachings of determining spatial weighting using sharpness score as taught by Frost for defining the claimed specifics of obtaining the optimal focused image in the invention of Adelson. One would have been motivated to use the teachings of determining spatial weighting using sharpness score as taught by Frost for defining the claimed specifics of obtaining the optimal focused image in the invention of Adelson because both references are directed to obtaining optimal focused image and Frost further provides the specifics of obtaining optimal focused image based on spatial weighting of which Adelson does not provide the specifics. Frost provides a method for automatically focusing on biological specimens (same as Adelson), and more particularly to a microscope auto-focus system which automatically focuses on features, patterns, or specific types of objects to automatically identify objects of interest from a set of images collected from different focal depths and automatically selects the focal depth which corresponds to best focus on the objects of interests (col. 2, lines 1-5). Both references are based on the same principle of auto focusing to determine the best focus of the image and therefore it would have been obvious

to one of ordinary skill in the art to combine both references for better detailed specifics of generating a focused image. Further, Frost provides a process to bring into best focus only the objects of interest without the need to focus independently on each object of interest (column 2, lines 11 – 14).

Claim 7 recites " the method of claim 6 wherein the step of providing at least one image region in at least one image further comprises: determining a set of focus regions on the surface of the object; and aligning at least one focus region in at least one image". All the limitations recited in claim 7 have been similarly analyzed and rejected as per claim 6 in view of Adelson (col. 4, lines 1-16; lines 25-55; col. 5, lines 25-40; col. 6, lines 52-56). Also, Frost discloses of identifying objects of interest from a set of images collected from different focal lengths, which satisfy the limitation "determining a set of focus regions on the surface of the object" (column 2, lines 1-3). Frost in continuation also disclose "a method to bring into best focus only the objects of interest in a full field of view" (column 2, lines 11-14) and " a focus measure is computed for each of the images, where each focus measure is a function of at least one image measurement" (column 2, lines 26-29) which satisfy the limitation "aligning at least one focus region in at least one image".

Claim 12 recites "the method of claim 6 wherein the plurality of image regions comprises a greyscale image map". Frost discloses "a histogram is computed of the gray levels of the image" (column 7, lines 21-23 and lines 46-50) and it would be apparent to one of ordinary skill in the art that if the image is a grayscale image, different regions of image would also be grayscale images.

Claim 13 recites " the method of claim 6 wherein the step of providing a plurality of images further comprises: determining a coarse focus position". Frost discloses of computing an initial focus scan to determine the best focus (coarse focus) position and this process continues incrementally until a best focus position is achieved (column 9, lines 1-10 and lines 20-27). Each time the initial focus scan is performed a plurality of images are acquired (column 6, lines 11 – 14 and lines 65 - 66).

Claim 14 has been similarly analyzed and is rejected as per claim 13.

Regarding claim 18, as discussed in the rejection of claim 6, each image has its focus setting and each image region, which is a part of the image if being imaged will apparently (inherently) have at least one focus setting.

9. Claims 8, 9, 10 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Adelson, U.S. Patent No. 4,661,986, further in view of Frost et al, U.S. Patent No. 5,647,025 and further in view of Kubota et al, IEEE Publication, 2000, "Inverse filters for reconstruction of arbitrarily focused images from two differently focused images".

Regarding claims 8, 9, 10 and 11, Adelson does teach overlapping of regions (col. 4, lines 50-53) but both Adelson and Frost fails to disclose the use of fuzzy transition such as Gaussian, when one image region overlaps an adjacent image region. However, in the same field of the invention, Kubota discloses that when at least one region (foreground) overlaps another adjacent region (background) the overlapping results in blurring (fuzziness) which is a Gaussian function (in the left column of page 2). Further, **applicant has admitted in the specification (page 18, line 1-**

6) that this is well known in the art of image processing field. Therefore, it would have been obvious that one would have been motivated to incorporate the teaching of Kubota into the method of Frost for the purpose of generating an all-focused image in which both adjacent images are in focus because of the conventionality of this type of transition and because this will make the adjacent image portions to blend together and not be distracting to the viewer and, additionally, because the applicant has acknowledged that this is a well known procedure (page 18 of the specification).

10. Claims 15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Adelson, U.S. Patent No. 4,661,986 and further in view of Frost et al, U.S. Patent No. 5,647,025 and in further view of Palmquist et al., U.S. Patent No. 5,179,419.

Claim 15 recites "the method of claim 7 wherein the object is a fiber optic cable end face". Adelson does teach "the present invention is particularly suitable for use in microscopy for deriving an improved focus 2D image of a 3D microscope specimen" (col. 3, lines 38-40) and Frost also does teach obtaining focused image of a microscopic specimen. Both Adelson and Frost does not teach of generating a focused image of a fiber optic cable end face. However, Palmquist discloses the methods of detecting defects in optical fiber end faces. Palmquist same as combined invention of Adelson and Frost, is also directed to the determination of optimum focal position (column 3, lines 30-40) by acquiring a plurality of images (column 6, lines 42-45) and performing a sharpness measurement (column 6, lines 62-65) on each of the image portions but the image portion belongs to a fiber optic cable end face. Palmquist same as Frost determines the coarse focus position and comprises of grayscale image map for each image (column 8, lines 1-4). Therefore, it would have been obvious for one of ordinary skill in the art at the time of invention was made to use the

combined method of Adelson and Frost in generating a focused image of a fiber optic cable end face as done by Palmquist because Frost same as Adelson provide a method for automatically focusing on microscopic specimens, and Frost more particularly to a microscope auto-focus system which automatically focuses on features, patterns, or specific types of objects to automatically identify objects of interest from a set of images collected from different focal depths and automatically selects the focal depth which corresponds to best focus on the objects of interests (col. 2, lines 1-5). Optical fibers, as known, are very micro-sized such as biological specimens and in order to obtain the best-focused composite image of the optical fiber surface, a microscopic image taking system is required and which is provided by the combined invention of Adelson and Frost. Therefore, one of ordinary skill in the art would be motivated to use the combined invention of Adelson and Frost to obtain the best focused composite image of the optical fiber surface by the use spatial weighting.

Claim 16 recites "the method of claim 15 wherein the set of regions are annular". Frost discloses a spiral pattern formation around the original starting focus point when determining a set of focus regions on the surface of the object.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Manav Seth whose telephone number is (571) 272-7456. The examiner can normally be reached on Monday to Friday from 8:30 am to 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta, can be reached on (571) 272-7453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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Art Unit 2625
March 2, 2006